

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Priority Application Serial No. 09/389,533
Priority Filing Date September 2, 1999
Inventor Alan R. Reinberg
Assignee Micron Technology, Inc.
Priority Group Art Unit 2823
Priority Examiner T. Pham
Attorney's Docket No. MI22-1952
Title: Methods of Forming Capacitors and Resultant Capacitor Structures

PRELIMINARY AMENDMENT

To: Assistant Commissioner for Patents
Washington, D.C. 20231

From: Frederick M. Fliegel, Ph.D.
(Tel. 509-624-4276; Fax 509-838-3424)
Wells St. John P.S.
601 W. First Avenue, Suite 1300
Spokane, WA 99201-3817

Sir:

This is a preliminary amendment accompanying a Request for Continuation Application for the above-entitled patent application. Prior to examining the application, please enter the following amendments.

AMENDMENTS

In the Specification

At page 1, after the title, insert:

CROSS REFERENCE TO RELATED APPLICATION

This patent application is a Continuation Application of U.S. Patent Application Serial No. 09/389,533, filed September 2, 1999, entitled "Methods Of Forming Capacitors and Resultant Capacitor Structures", naming Alan R. Reinberg as inventor.

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In the Claims

Please cancel claims 19-52 without prejudice, amend the claims and add claims 53-62 as follows:

1. (Amended) A method of forming a capacitor comprising:

forming a capacitor storage node layer over a substrate, the capacitor storage node layer having an uppermost rim defining an opening into an interior volume; and

forming a cap by capping at least a portion of the rim within the interior volume by forming a material which is different from the capacitor storage node layer over the rim portion, said material as received at least over the rim portion not functioning primarily as a capacitor dielectric material for the capacitor.

2. The method of claim 1, wherein the capping of the rim portion comprises forming an insulative material thereover.

3. The method of claim 1, wherein the capping of the rim portion comprises forming an insulative material within less than an entirety of the interior volume.

4. The method of claim 1, wherein the capping of the rim portion comprises forming an insulative material layer over the substrate and anisotropically etching the insulative material layer.

5. The method of claim 1 further comprising prior to the capping of the rim portion, filling less than the interior volume with a filler material which is present during the capping.

6. The method of claim 1 further comprising prior to the capping of the rim portion, filling less than the interior volume with a filler material which is present during the capping, and wherein the capping of the rim portion comprises forming an insulative material layer over the substrate and the filler material and anisotropically etching the layer.

7. The method of claim 1, wherein the forming of the capacitor storage node layer comprises:

forming a container into a container-defining material over the substrate;

forming a capacitor storage node layer within the container; and

recessing the capacitor storage node layer to below an uppermost surface of the container-defining material.

8. The method of claim 7, wherein the capacitor storage node layer comprises roughened polysilicon.

9. The method of claim 1, wherein the forming of the capacitor storage node layer comprises:

forming a container into a container-defining material over the substrate;

forming a capacitor storage node layer within the container;

recessing the capacitor storage node layer to below an uppermost surface of the container-defining material; and

after the capping of the rim portion, removing at least some of the container-defining material.

10. The method of claim 9, wherein the removing of the container-defining material comprises removing said container-defining material selectively relative to the capping material which is formed over the rim portion.

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11. The method of claim 1, wherein the forming of the capacitor storage node layer comprises:

forming a container into a container-defining material over the substrate;

forming a capacitor storage node layer within the container;

recessing the capacitor storage node layer to below an uppermost surface of the container-defining material; and

wherein the capping of the rim portion comprises forming an insulative material layer over the substrate and anisotropically etching the insulative material layer.

12. The method of claim 1, wherein the forming of the capacitor storage node layer comprises:

forming a container into a container-defining material over the substrate;

forming a capacitor storage node layer within the container;

recessing the capacitor storage node layer to below an uppermost surface of the container-defining material; and

further comprising prior to the capping of the rim portion, filling less than the interior volume with a filler material.

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13. The method of claim 1, wherein the forming of the capacitor storage node layer comprises:

forming a container into a container-defining material over the substrate;

forming a capacitor storage node layer within the container;

recessing the capacitor storage node layer to below an uppermost surface of the container-defining material; and

further comprising prior to the capping of the rim portion, filling less than the interior volume with a filler material, and

wherein the capping of the rim portion comprises forming an insulative material layer over the substrate and the filler material and anisotropically etching the insulative material layer.

14. (Amended) A method of forming a capacitor comprising:

forming a capacitor storage node layer over a substrate, the capacitor storage node layer having an uppermost rim defining an opening into an interior volume; and

forming a layer of material over the uppermost rim within the interior volume.

15. (Amended) The method of claim 14, further comprising anisotropically etching said layer sufficient to leave a portion of the material occluding the opening.

16. (Amended) The method of claim 14, further comprising anisotropically etching said layer sufficient to leave a portion of the material extending into the interior volume.

17. (Amended) The method of claim 14, further comprising anisotropically etching said layer sufficient to leave a portion of the material extending into the interior volume and occluding the opening.

18. The method of claim 14, wherein the forming of the layer of material comprises forming a portion of said layer to contact the storage node layer.

New Claims

53. The method of claim 1, further comprising, after capping the rim, forming a capacitor dielectric region and a cell electrode layer over the capacitor storage node layer within the interior volume.

54. The method of claim 14, further comprising anisotropically etching the layer of material.

55. A method of forming a capacitor comprising:

forming a capacitor storage node layer comprising roughened polysilicon over a substrate, the capacitor storage node layer having an uppermost rim defining an opening into an interior volume;

forming an insulative cap by capping at least a portion of the rim within the interior volume by forming a material which is different from the capacitor storage node layer over the rim portion, said material as received at least over the rim portion not functioning primarily as a capacitor dielectric material for the capacitor; and

after the capping of the rim, forming a capacitor dielectric region and a cell electrode layer over the capacitor storage node layer.

56. The method of claim 55, wherein capping comprises forming an insulative material within less than an entirety of the interior volume.

57. The method of claim 55, wherein capping comprises forming an insulative material layer over the substrate and anisotropically etching the insulative material layer.

58. The method of claim 55, further comprising, prior to capping, filling less than the interior volume with a filler material which is present during capping.

59. The method of claim 55, further comprising, prior to capping, filling less than the interior volume with a filler material which is present during capping, and wherein capping comprises forming an insulative material layer over the substrate and the filler material and anisotropically etching the layer.

60. The method of claim 55, wherein forming the capacitor storage node layer comprises:

forming a container into a container-defining material over the substrate;

forming the capacitor storage node layer within the container; and

recessing the capacitor storage node layer to below an uppermost surface of the container-defining material.

61. The method of claim 55, wherein forming the capacitor storage node layer comprises:

forming a container into a container-defining material over the substrate;

forming the capacitor storage node layer within the container;

recessing the capacitor storage node layer to below an uppermost surface of the container-defining material; and

after capping, removing at least some of the container-defining material.

62. The method of claim 61, wherein removing the container-defining material comprises removing said container-defining material selectively relative to the capping material which is formed over the rim portion.

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REMARKS


Claims 1 and 14-17 have been amended, claims 19-52 have been canceled and new claims 53-62 have been added. Consideration of the application as amended is requested.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page(s) are captioned "**Version with markings to show changes made.**"

The amendments to the specification and claims and new claims 53-62 are supported at least by text appearing at p. 4, line 14 through p. 13, line 11 of the application as originally filed. No new matter is added by the amendments to the specification or claims, or by new claims 53-62.

This application is believed to be in condition for allowance and action to that end is requested. The Examiner is requested to telephone the undersigned in the event that the next office action is one other than a Notice of Allowance. The undersigned is available during normal business hours (Pacific Time Zone).

Respectfully submitted,

Dated: Feb. 22, 2002 By: 
Frederick M. Fliegel, Ph.D.
Reg. No. 36,138

Version with markings to show changes made.

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Title: Methods of Forming Capacitors and Resultant Capacitor Structures

37 CFR §1.121(b)(1)(iii) AND 37 CFR §1.121(c)(1)(ii)
FILING REQUIREMENTS TO ACCOMPANY PRELIMINARY AMENDMENT

Deletions are bracketed, additions are underlined.

In the Specification

At page 1, the following text has been inserted:

CROSS REFERENCE TO RELATED APPLICATION

This patent application is a Continuation Application of U.S. Patent
Application Serial No. 09/389,533, filed September 2, 1999, entitled "Methods
Of Forming Capacitors and Resultant Capacitor Structures", naming Alan R.
Reinberg as inventor.

In the Claims

1. (Amended) A method of forming a capacitor comprising:

forming a capacitor storage node layer over a substrate, the capacitor storage node layer having an uppermost rim defining an opening into an interior volume; and

forming a cap by capping at least a portion of the rim within the interior volume by forming a material which is different from the capacitor storage node layer over the rim portion, said material as received at least over the rim portion not functioning primarily as a capacitor dielectric material for the capacitor [; and

after the capping of the rim, forming a capacitor dielectric region and a cell electrode layer over the capacitor storage node layer].

14. (Amended) A method of forming a capacitor comprising:

forming a capacitor storage node layer over a substrate, the capacitor storage node layer having an uppermost rim defining an opening into an interior volume; and

forming a layer of material over the uppermost rim within the interior volume [; and

anisotropically etching the layer of material].

15. (Amended) The method of claim 14, [wherein said etching comprises] further comprising anisotropically etching said layer sufficient to leave a portion of the material occluding the opening.

16. (Amended) The method of claim 14, [wherein said etching [comprises] further comprising anisotropically etching said layer sufficient to leave a portion of the material extending into the interior volume.

17. (Amended) The method of claim 14, [wherein said etching comprises] further comprising anisotropically etching said layer sufficient to leave a portion of the material extending into the interior volume and occluding the opening.

Claims 19-52 have been canceled and claims 53-62 have been added.

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